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literature and putting forward many ingenious suggestions regarding the possible phylogeny of the coelome, blood-vessels and musculature, the origin of metamerism, and other deep-lying morphological problems. Phylogenetic speculations on embryological data are getting out of fashion, and some of Meyer's conclusions will doubtless meet with little sympathy on the part of those whose interest in the historical problems of morphology has suffered a temporary attack of paralysis through devotion to more 'modern' questions. Even the sceptical reader, however, who will take the trouble to examine Meyer's work with care, will not be able to deny that the theoretical views are everywhere held closely in touch with admirably thorough and extended observation, and constitute no mere inflated speculative system, but a natural working hypothesis growing directly out of the facts.

In the present paper Meyer considers only the larval development; and his results form a most important supplement to that of students of cell-lineage, who have not, in general, carried their work to a sufficiently late period to determine the real relation of the germ-layers to the adult body. It may be pointed out, however, that the comparative study of cell-lineage in platodes, annelids and mollusks has steadily added weight to Meyer's original contention of a double origin of the 'mesoblast,' for it has shown that in the two higher groups a 'larval mesenchyme' is often formed from cells of the ectoblastic quartets, which are quite distinct from the pole-cells of the secondary mesoblast, the latter (with the apparent exception of *Capitella*) being always derived from a cell of the fourth quartet (otherwise entoblastic). The cell ancestry of the larval mesenchyme thus agrees in a general way, though with interesting modifications of detail, with that of the mesenchyme (mesoblast) of polyclades, which inevitably and independently suggests the same view as that of Meyer, though from a quite different point of view.* Meyer's observations render it in the highest degree probable that, as the writer has suggested, mesen-

chyme may arise from any of the three ectoblastic quartets; for (not to mention the so-called 'head-kidneys' of *Nereis*), such origin has already been observed in the second and third, and if the cell-lineage of *Polygordius* and *Lopadorhynchus* is of the same type as in other annelids, as can hardly be doubted, the umbrellar neuro-muscular foundations in these forms must be derivatives of the first quartet.

The gonad theory of the coelome, which Meyer has done so much to advance, has made a deep impression on morphology, as may be seen, for instance, by reference to the admirable review of the theories of the coelome by Ray Lankester in the second volume of his 'Treatise on Zoology,' which appeared last year; and it has made serious inroads on the widely accepted enterocoele theory. Whether the two views can be reconciled is not to be determined without further research; for some of the most important observations on which Rabl, Lankester and others have relied in attempting to trace the transition from the pole-cell type to the enterocoele type (*e. g.*, pole-cells in *Amphioxus*, gut-pouches in *Paludina*) have been shown to be erroneous. Meyer believes the enterocoele type to be secondary; Lankester accepts the reverse view. Others have suggested the possibility that the two types have been distinct from the beginning, and this has for years been held open in the writer's advanced lectures on zoology and embryology as a possible basis for a division of the 'triblastic' animals into two parallel but independent series that diverged further down than the platodes—a division which, though entirely provisional, and as yet without adequate basis, nevertheless brings into order a surprisingly large number of facts otherwise difficult to reconcile. This is a question for the future, and may be left with Lankester's significant remark, that "When the cell-lineage of mesenchyme and its tissue-products has been cleared up we may be able finally to put aside the hasty criticisms and phantastic assertions of those who have grown impatient over the slow and difficult task of cellular embryology." EDMUND B. WILSON.

* Cf. Wilson, 'Considerations on Cell-lineage and Ancestral Reminiscence,' in *Annals N. Y. Academy of Sciences*, XI., 1, 1898.

Publications of the University of Pennsylvania, Astronomical Series. Volume I., Part III.
The work before us is Part III., of the publi-

cations begun by the University of Pennsylvania for the new Flower Observatory, which was formally inaugurated with a public address by Professor Simon Newcomb in November, 1897. The Flower Observatory is widely known among astronomers as a new institution managed on a solid conservative basis, by a gifted and devoted staff of untiring workers. Though it has been in operation but a few years, it has already taken its place among the leading observatories of the country. It is distinguished by the care and accuracy of all its work rather than by the quantity of material turned out; and for that reason it has from the start taken rank with the best of modern observatories. The care and painstaking accuracy which characterized Professor C. L. Doolittle's work at the Sayre Observatory in Bethlehem, Pa., was at once recognizable in the spirit of the new institution under his direction at Philadelphia; and the results are now becoming apparent in the first volume of the 'Publications.'

Part II. of this volume appeared more than a year ago, and dealt in a characteristically thorough manner with the variations of latitude observed at Philadelphia, and with several determinations of the constant of aberration incidentally made in connection with the latitude work. This constant came out somewhat larger than the value which had generally been used by astronomers. The value found by Struve and Peters at Poulkova was $20''.44$, and for many years this was accepted as standard; but recent investigations by several authorities tend to increase the figure to about $20''.55$, which is the value found by Professor Asaph Hall, Jr., at the Detroit Observatory of the University of Michigan. Professor C. L. Doolittle's several determinations confirm this larger value; and on account of the care and precautions exercised in the work, there is little doubt in the minds of conservative astronomers that this new figure is much nearer the truth than that adopted in the nautical almanacs.

Part III. of Volume I. of the New Publications is devoted to the measures of 900 double and multiple stars made with the 18-inch Brashear refractor of the Flower Observatory, by Professor Eric Doolittle, son of the director

of the Observatory. This part consists of 146 large quarto pages of closely set matter, all beautifully and conveniently arranged. There is no defect in the conception or execution of the work, and it is not too much to say that this publication may be taken as a model for astronomers generally.

A concise introduction of eight pages deals with the constants of the equatorial, and with the micrometer employed in the measures. The latter is an ordinary filar micrometer, with the Burnham illumination. Its simplicity enabled the observer to center his whole attention on the work, and the result is a handsome volume of measures on 900 double and multiple stars, all made within the past four years. The stars are chosen mostly from the lists of Burnham, with occasional selections from the Struves and Dewbowski, and such modern observers as Hough and See. They represent in all cases objects requiring measurements. Though no special search was made for new double stars, a list of 22 such objects found in the prosecution of the regular work is given on page 8; all of them being close or interesting pairs which should receive the attention of future observers. The 900 stars measured are arranged in order of right ascension, with places referred to the epoch 1880.0. Their magnitudes and the several designations used by astronomers are clearly and accurately given in each case. The measures are nicely reduced and annual means are formed, according to the classic models of the Struves, Dewbowski and Burnham. The notes accompanying the measures are brief and to the point; no important matter is overlooked, and yet nothing superfluous is ever added. The total number of complete observations is about 3,700, representing something like 44,000 settings of the micrometer.

It should be pointed out that all these observations were taken and reduced by Professor Eric Doolittle alone, in addition to his teaching duties at the University, where he conducts advanced courses of instruction in celestial mechanics. In conclusion it may be noticed that publications dealing with the measurement of double stars are not merely of contemporary interest, but increase in value with time. Thus the work of the Herschels, the Struves and

Dewbowski are immensely more valuable now than when they were made many years ago, by reason of changes in the sidereal heavens which have since intervened; and all precise work such as that now being done at the Flower Observatory is assured of a lasting and honorable place in the history of science. Scientific research prosecuted for its own sake is among the most noble of intellectual pursuits, and the University of Pennsylvania is much to be congratulated on the distinguished place it is acquiring in the astronomical world.

T. J. J. SEE.

WASHINGTON, D. C.

A History of the Precious Metals from the Earliest Times to the Present Day. By ALEX. DEL MAR. Second edition, revised. New York, Cambridge Encyclopedia Co. 1902. 8vo. Illustrated. Pp. xxii + 480, 1-9.

The first edition of this remarkable work was published at London in 1880 and has long since been exhausted; meanwhile the author, in his profession of mining engineer, has visited many remote sources of the precious metals and has secured at first hand new material which has caused the volume to be entirely rewritten. This history is prepared by a profound student, from the point of view of the antiquarian, the archeologist and of the metallurgist, as well as the political economist, and deals with the exploration of the entire surface of the globe for gold and silver from the earliest record of mankind to the present day; copper, tin and the other heavy metals are only incidentally treated. The author is particularly well qualified for this vast undertaking, having already published several serious studies on money, its history, its science and its bearing on the progress of civilization, and having held positions of authority under the United States government, Director of the United States Bureau of Statistics, Mining Commissioner, and member of the International Congresses which met at Turin and at St. Petersburg. He is now engaged on 'The Romance of the Precious Metals' and 'The Politics of Money,' both of which are well advanced.

Mr. Del Mar maintains that the principal motive which has led to the dominion of the earth

by civilized races is the desire for the precious metals, rather than geographical research or military conquest; that the occurrence of gold has invited commerce, and the latter has been followed by invasion and eventually permanent occupation. With these facts in mind he portrays the stupendous power exerted by the quest for the precious metals from the beginnings of history in India, Persia, Egypt, Greece, Italy, Spain and the Western Hemisphere. He depicts very vividly the painful ways in which each gold-producing country has been mercilessly plundered by more powerful neighbors, saying that 'mining is slow work compared with plundering.' He also shows elsewhere that mining is generally more expensive than plundering, except where forced labor and slavery is employed. And to illustrate the latter point he claims that 'since the discovery of America the European world has acquired 19,500 and odd millions of dollars, of which 1,000 millions were obtained by conquest, 9,500 millions by slavery and 9,000 millions chiefly by free mining labor.'

Recognizing these sources of the precious metals he is decidedly opposed to the dictum of certain philosophers that the value of gold is its 'cost of production,' and says this formula does not take into account the 'millions of human lives, the rivers of human tears, the oceans of human blood, the immeasurable amount of human anguish.'

This aspect of the case is set forth in powerfully written chapters on the plunder of America (by the Spaniards), of Africa (from the Roman Emperors to South African War), of Asia (by the Romans, Portuguese and the British), and of China in all ages; chapters showing great historical research and learning. The author's arraignment of Spain is particularly interesting at this epoch: "Besides despoiling aboriginal America of her gold and silver, Spain accomplished nothing in the New World except extermination and destruction. She swept away half as many human lives as all Europe contained at the period of the discovery of America. She destroyed every memorial of the Aztec and Peruvian civilizations. She disfigured the entire face of Central and South America. And she planted nothing